

1 CLAIMS

2 What is claimed is:

3 1. A method of implementing a cellular automata based random number  
4 generator (CA-based RNG), comprising:

5 determining an interconnection topology;

6 screening a CA-based RNG candidate based on said interconnection topology;

7 and

8 subjecting said CA-based RNG candidate to a suite of random number tests in  
9 response to said CA-based RNG passing said screening step.

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11 2. The method of claim 1, wherein said CA-based RNG candidate is  
12 under a periodic boundary condition in at least one dimension.

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14 3. The method of claim 1, wherein said interconnection topology is  
15 identical for all cells of said CA-based RNG candidate.

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17 4. The method of claim 1, wherein said determining topology (310) step  
18 includes:

19 exhaustively providing all possible interconnection topologies for a given  
20 neighborhood number for cells of said CA-based RNG candidate.

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1           5.       The method of claim 4, wherein said determining topology (310) step  
2 further includes:

3           pruning said interconnection topologies to reject interconnection topologies  
4 for which no input of a cell of said CA-based RNG candidate is connected to said  
5 cell's output.

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7           6.       The method of claim 4, wherein said determining topology (310) step  
8 further includes:

9           pruning said interconnection topologies to reject interconnection topologies  
10 for which displacement values for all inputs for a cell are evenly divisible by a length  
11 of said CA-based RNG for any displacement values whose absolute value is greater  
12 than 1.

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14           7.       The method of claim 1, wherein said screening (320) step includes:  
15           calculating entropy of said CA-based RNG candidate; and  
16           accepting said CA-based RNG candidate for testing based on one or more  
17 predetermined criteria.

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19           8.       The method of claim 7, wherein said calculating entropy step includes:  
20           calculating an expected value of a subsequence within a sequence;  
21           initializing said CA-based RNG candidate through a predetermined number of  
22 clock cycles and monitoring occurrences of said subsequence; and

23           determining said entropy based on said expected value and results of  
24 monitoring said subsequence occurrences.

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1           9.       The method of claim 8, further comprising:  
2           rejecting said CA-based RNG in response said occurrence being greater than a  
3           multiple of said expected value.  
4

5           10.     The method of claim 7, wherein said accepting step includes accepting  
6           said CA-based RNG candidate for testing in response to said CA-based RNG  
7           candidate being in a list of a predetermined number of highest entropy CA-based  
8           RNG candidates.  
9

10          11.     The method of claim 10, wherein said accepting step includes  
11          accepting said CA-based RNG candidate for testing in response to said entropy of  
12          said CA-based RNG candidate being at or above a predetermined threshold entropy.  
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14          12.     The method of claim 1, wherein said standardized suite of random  
15          number tests includes the DIEHARD suite of tests.  
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17          13.     The method of claim 1, further comprising:  
18          selecting said CA-based RNG candidate in response to said CA-based RNG  
19          candidate passing said suite of random number tests without at least one of time  
20          spacing and site spacing.  
21

22          14.     A cellular automata based random number generator (CA-based RNG)  
23          implementing-module, comprising:

24               an       interconnection-topology-determining-module       determining       an  
25          interconnection topology;

1 a screening-module screening a CA-based RNG candidate based on said  
2 interconnection topology; and

3 a testing-module subjecting said CA-based RNG candidate through a suite of  
4 tests in response to said CA-based RNG passing through said screening-module.

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6 15. The CA-based RNG implementing-module of claim 13, wherein said  
7 screening-module comprises:

8 an entropy-calculating-module calculating entropy of said CA-based RNG  
9 candidate; and

10 a sorting-module accepting or rejecting said CA-based RNG candidate for  
11 testing based on a predetermined criteria.

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13 16. The CA-based RNG implementing-module of claim 15, wherein said  
14 entropy-calculating-module comprises:

15 an expected-value-module calculating an expected count value of  
16 subsequences within a sequence;

17 an accumulating-module accumulating actual counts of said subsequences;  
18 and

19 an entropy-determining-module determining said entropy based on an output  
20 or outputs of said accumulating-module;

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22 17. The CA-based RNG implementing-module of claim 15, wherein said  
23 sorting-module accepts said CA-based RNG candidate for testing in response to said  
24 CA-based RNG candidate being in a list of a predetermined number of highest  
25 entropy CA-based RNG candidates.

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2           18.     The CA-based RNG implementing-module of claim 15, wherein said  
3     sorting-module accepts said CA-based RNG candidate for testing in response to said  
4     entropy of said CA-based RNG candidate being at or above a predetermined threshold  
5     entropy.

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7           19.     The CA-based RNG implementing-module of claim 14, wherein said  
8     interconnection-topology-determining-module comprises:

9           a topology-generation-module generating one or more interconnection  
10    topologies; and

11          a topology-pruning-module pruning said interconnections based on one or  
12    more predetermined criteria.

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14           20.     The CA-based RNG implementing-module of claim 19, wherein said  
15    topology-generation-module exhaustively provides all possible interconnection  
16    topologies for a given neighborhood number for cells of said CA-based RNG  
17    candidate.

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19           21.     The CA-based RNG implementing-module of claim 19, topology-  
20    pruning-module prunes said interconnection topologies to reject interconnection  
21    topologies for which no input of a cell of said CA-based RNG candidate is connected  
22    to said cell's output.

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24           22.     The CA-based RNG implementing-module of claim 19, topology-  
25    pruning-module prunes said interconnection topologies to reject interconnection

- 1 topologies for which displacement values for all inputs for a cell are evenly divisible
- 2 by a length of said CA-based RNG for any displacement values whose absolute value
- 3 is greater than 1.

2025 RELEASE UNDER E.O. 14176